Hot, Recycled–Solid Pilot Plant

Advanced processing of oil shale, wastes, and heavy oil

The processing of hot solids—central to many energy and waste-treatment technologies—presents a technical challenge because common control and monitoring systems cannot handle such materials, and scale up is difficult. We have built a pilot facility that can recycle 4 t/day of solid materials in a process that involves several dilute- and dense-phase processing units. With minor modifications, the facility should also be able to process other materials—we have successfully tested surrogate nitrate waste.

Fundamental research in oil-shale processing

Oil shale deposits in the western United States represent an enormous liquid fuel resource. Our objective is to demonstrate the advanced technology that could lead to an economic and environmentally acceptable commercialization of that resource. We are investigating hot, recycled solid (HRS) oil-shale retorting through

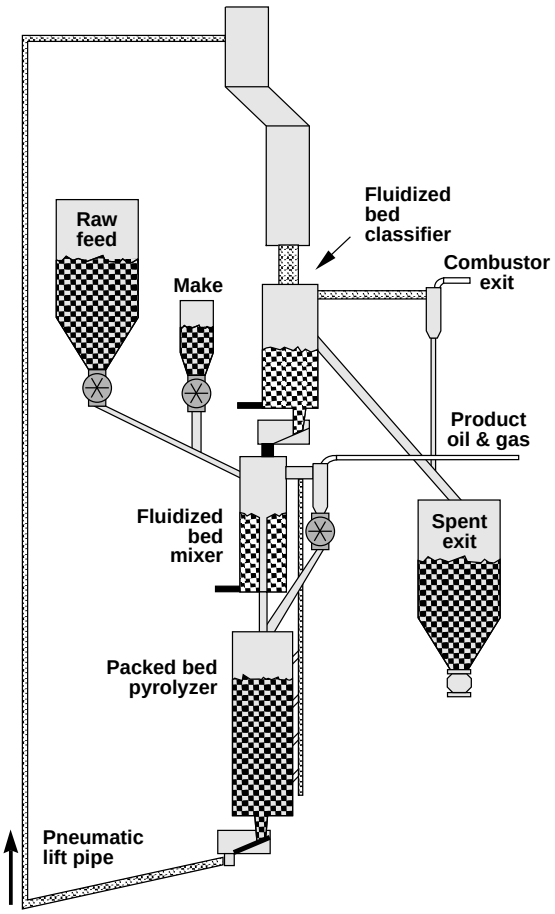
- Fundamental research
- Operation of a 4 t/day HRS pilot plant
- Development of an oil-shale process mathematical model that serves as a critical judge of experiments and an aid in process scale up.

APPLICATIONS

- *Recovery of liquid fuel from oil shale*
- *Destruction of nitrate-containing waste*
- *Destruction of organic-containing waste*
- *Upgrading of heavy oil*

Pilot-plant process

The pilot plant consists of a circulating loop and peripheral equipment. Major units (see figure) include a fluidized bed mixer (FBM), a moving packed bed pyrolyzer (PYR), a pneumatic lift pipe (LFT), and a fluidized bed classifier/combustor (FBC). Solids circulate around the loop at 10 kg/min. Fresh shale, crushed to 7 mm or less, is mixed with hot circulating solids in the FBM. Pyrolysis occurs in 2 to 3 min in the FBM and PYR, and the oil vapor, which contains water and dust, passes through cyclones and filters prior to a staged cooling process for product recovery. Residual carbon on the spent shale is combusted in the LFT and FBC, thus providing heat for the process and completing the circulation loop.



Livermore's hot, recycled-solid retort, configured for oil shale.

Availability: We have completed several test runs of the 4 t/day pilot plant to demonstrate the technical feasibility of the HRS process and answer key scale-up questions. We seek industrial partners with whom we can further develop and commercialize the HRS technology.

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